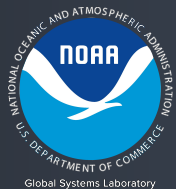


NOAA Global Systems Laboratory

# Generating Storm Surge Hazards In Hazard Services: Progress Report

Taylor Trogdon<sup>1</sup>, Nathan Hardin<sup>2</sup>, Daniel Nietfeld<sup>2</sup>, David Tomalak<sup>2</sup>, Darrel Kingfield<sup>2</sup>, Brian Zachry<sup>3</sup>, Jamie Rhome<sup>3</sup>, Cody Fritz<sup>3</sup>

<sup>1</sup>CIRA and NOAA/ESRL/GSL; <sup>2</sup>NOAA/OAR/GSL; <sup>3</sup>NOAA/NWS/NCEP/NHC



Interdepartmental Hurricane Conference  
10 March, 2022

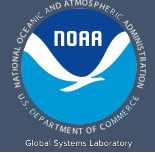


# What Is Hazard Services?

*“A multi-year, multi-phase effort that modernizes how hazardous weather products are generated by the NWS.”*

- 1.) Hazard services for Weather Forecast Offices (WFOs)
- 2.) **Hazard services for National Centers (NCs)**
- 3.) Hazard services for Forecasting a Continuum of Environmental Threats (FACETs)

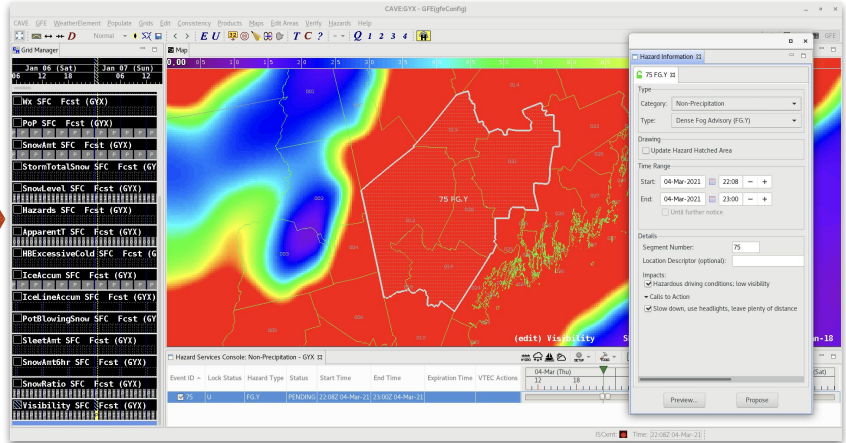
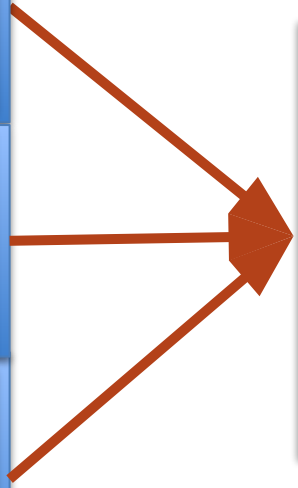
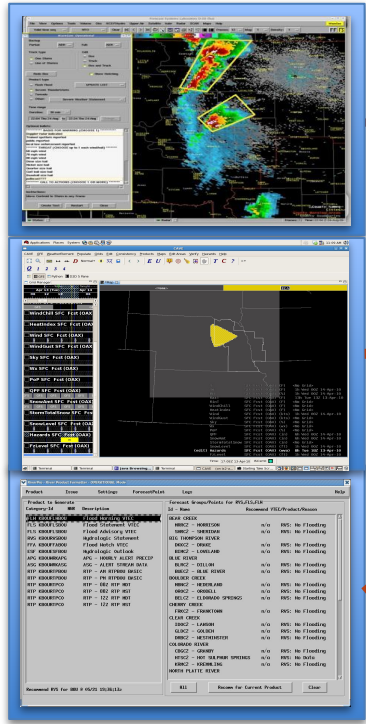
# Hazard Services: The Backbone of a Weather Ready Nation



**WarnGen**

**Graphical  
Hazard  
Generator**

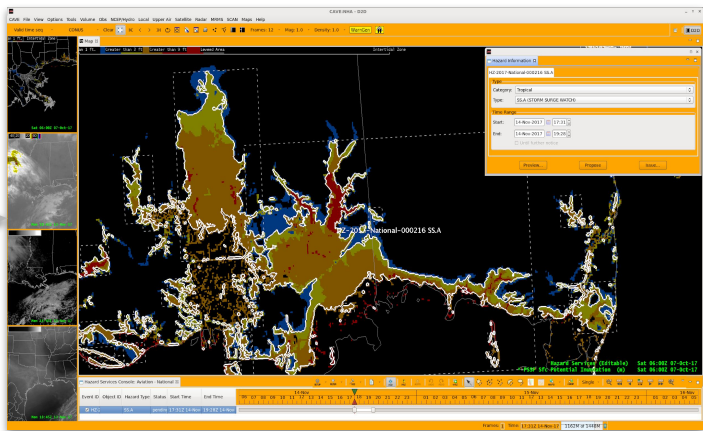
**RiverPro**



**Hazard Services**

**20-30 Year Old Hazard Forecasting Platforms**

## Hazard Event Output



# Project Background



- **Funded through JTTI**
  - *Joint-Technology Transfer Initiative*
  - Serves to ensure continuous development and transition of technological advances into NWS operations
  - Under the Weather Program Office (WPO) umbrella
- **Principal Investigator:** CSU-CIRA in cooperation with NOAA/ESRL/GSL: Taylor Trogon
- **Program Managers:** Nathan Hardin, Darrel Kingfeld (NOAA/OAR/ESRL/GSL)
- **NWS Collaborators:** Jamie Rhome (NWS/NCEP/NHC); Ashley Kells (NWS/OPPSD/CP); Daniel Nietfeld (NOAA/ESRL/GSL); Brian Zachry (NWS/NCEP/NHC); Cody Fritz(NWS/NCEP/NHC)
- **Project Lifespan:**
  - 2-year award - funded through FY22

## Modernize the storm surge workflow/migrate into Hazard Services

- **Current operational limitations:**
  - Degraded spatial resolution of the Storm Surge Watch/Warning (2.5km in GFE)
  - Discontinuities between Potential Storm Surge Flooding Graphic (High-resolution inundation mapping) and Storm Surge Watch/Warning
  - Dissemination challenges of hyper-local storm surge threat
    - Current zone-based approach results in over-warning
- **How can Hazard Services help?**
  - Implement polygon-based approach - reduction in geographic extent/overwarning
  - Recommender framework (uses high-resolution inundation graphic to generate first-guess warning)
  - Severity tag capability (warning hierarchy)
  - Common Alerting Protocol (CAP) message generation

# Where Are We?

- Currently ***ahead*** of schedule
- Beginning RL of 3
- Current RL of 7  
(demonstrated software in operational environment)

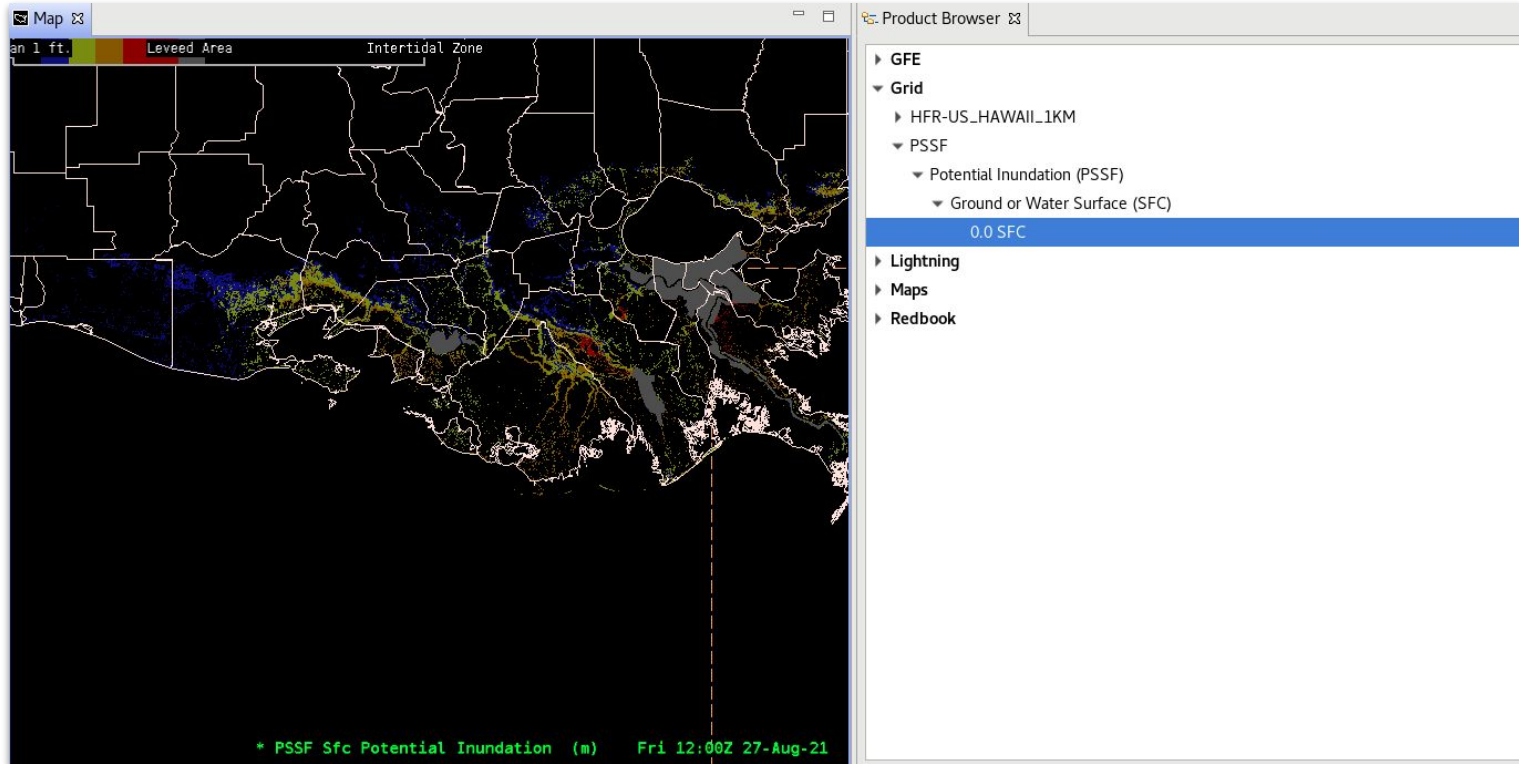
## Completed Milestones

| Milestones   |
|--|
| 01/2021: Requirements finalized with NHC guidance                                |
| 04/2021: Google design document delivered to NHC                                 |
| 05/2021: Design approved by Architectural Review Board (ARB)                     |
| 05/2021: Design presented to NHC   |
| 05/2021: New NHC Hazard Type configured in Hazard Services                       |
| 07/2021: Functional product generation and formatted text product produced by HS |
| 10/2021: Finalize prototype recommender to create first guess hazard extent      |
| 10/2021: Demonstrate initial workflow to NHC for evaluation and feedback         |
| 02/2022: Updates to software based on testing and evaluation                     |
| 03/2022: Finalize code and stage code review on VLAB                             |
| 05/2022: Complete code check-in and merge into HS VLAB repository                |
| 05/2022: Final delivery of code via RPM or AWIPS Cloud Instance                  |
| 08/2022: Final Evaluation of software capabilities and delivery                  |



# Proposed Forecaster Workflow

## Potential Storm Surge Flooding Graphic (PSSFG) ingested into AWIPS as netcdf

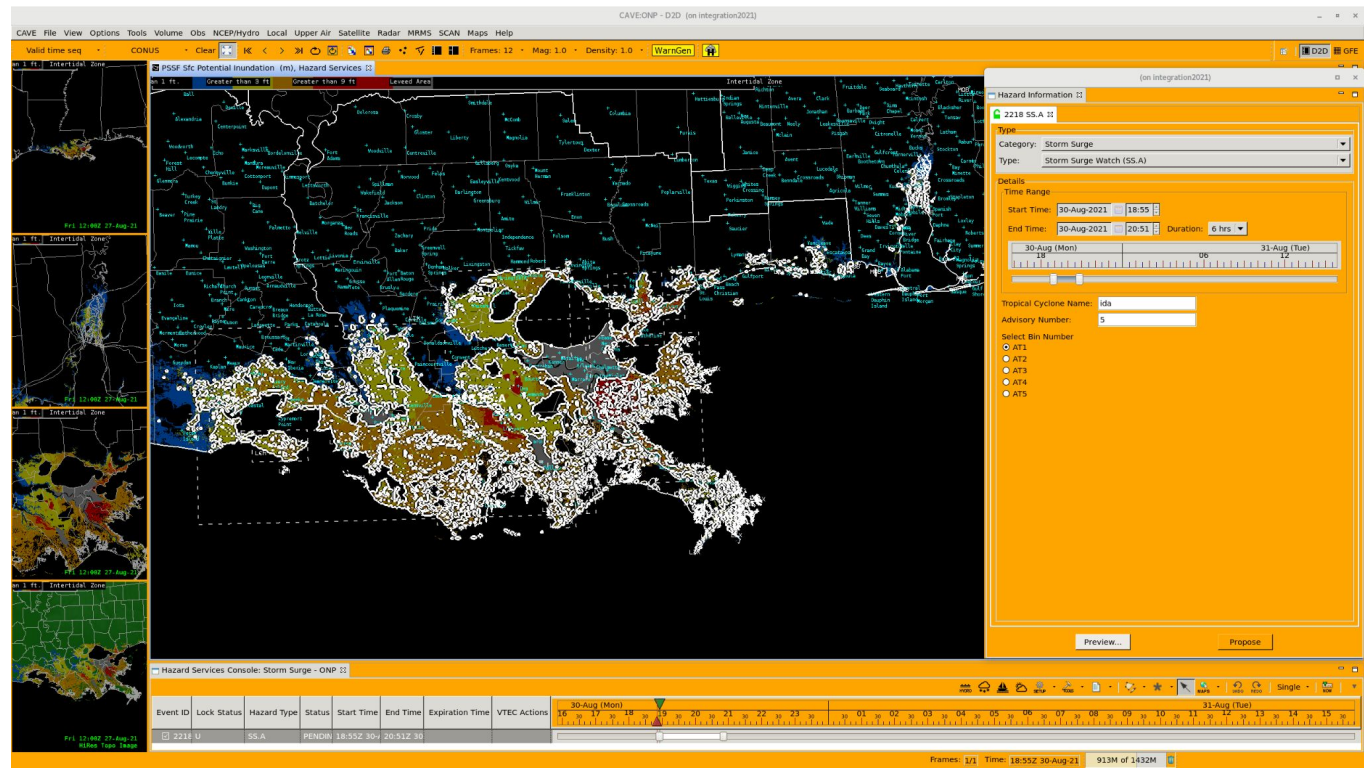




# Proposed Forecaster Workflow



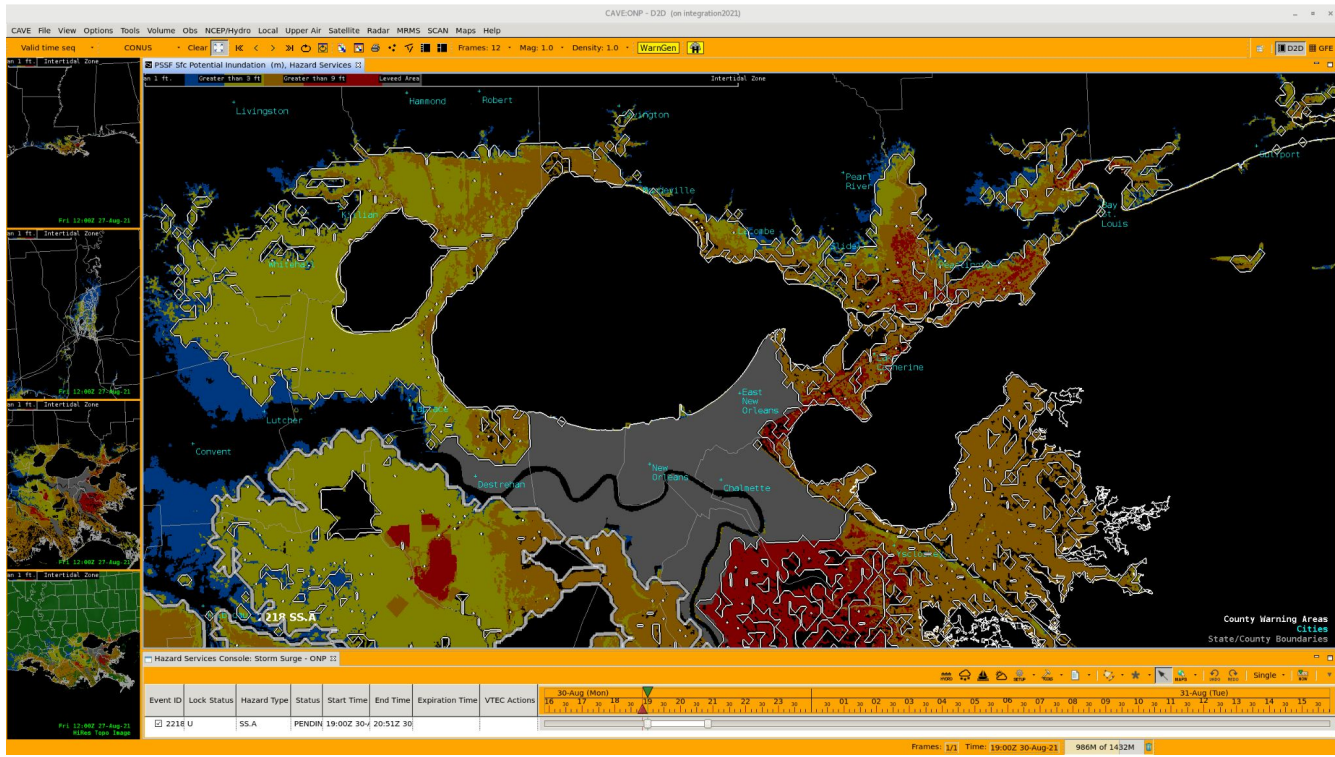
Recommender run using the PSSFG as input at native resolution (100s of meters)



# Proposed Forecaster Workflow



## First guess Watch/Warning generated from input data set (PSSFG)



# Proposed Forecaster Workflow

## Outputs Include:

### 1.) Common Alerting Protocol (CAP) message



Product Editor (on integration2021)

```

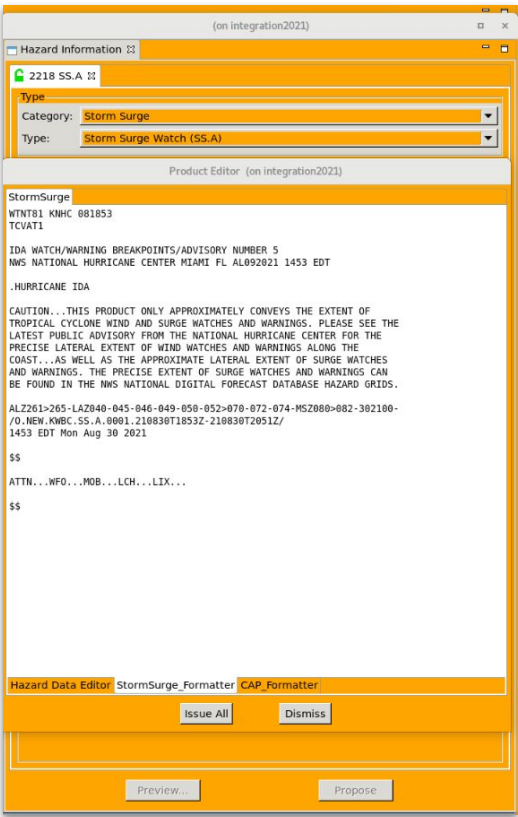
StormSurge
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</note>
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</responseType>
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</value>
</parameter>
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</parameter>
<parameter>
<valueName>BLOCKCHANNEL</valueName>
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</value>
</parameter>
</alert>

```

Hazard Data Editor: StormSurge\_Formatter CAP\_Formatter

Issue All Dismiss

### 2.) Legacy Text Product



(on integration2021)

Hazard Information

2218 SS.A

Type: Storm Surge

Type: Storm Surge Watch (SS.A)

Product Editor (on integration2021)

StormSurge

WNT81 KHNC 081853

TCVAT1

IDA WATCH/WARNING BREAKPOINTS/ADVISORY NUMBER 5

NWS NATIONAL HURRICANE CENTER MIAMI FL AL092021 1453 EDT

.HURRICANE IDA

CAUTION...THIS PRODUCT ONLY APPROXIMATELY CONVEYS THE EXTENT OF TROPICAL CYCLONE WIND AND SURGE WATCHES AND WARNINGS. PLEASE SEE THE LATEST PUBLIC ADVISORY FROM THE NATIONAL HURRICANE CENTER FOR THE PRECISE LATERAL EXTENT OF WIND WATCHES AND WARNINGS ALONG THE COAST...AS WELL AS THE APPROXIMATE LATERAL EXTENT OF SURGE WATCHES AND WARNINGS. THE PRECISE EXTENT OF SURGE WATCHES AND WARNINGS CAN BE FOUND IN THE NWS NATIONAL DIGITAL FORECAST DATABASE HAZARD GRIDS.

AL2261-265-LA2840-045-046-049-050-052-070-072-074-HS2080-082-302100-70.NEW.KHNC.SS.A.0001.210830T1853Z-210830T2051Z/1453 EDT Mon Aug 30 2021

\$\$

ATTN...WFO...MOB...LCH...LIX...

\$\$

Hazard Data Editor: StormSurge\_Formatter CAP\_Formatter

Issue All Dismiss

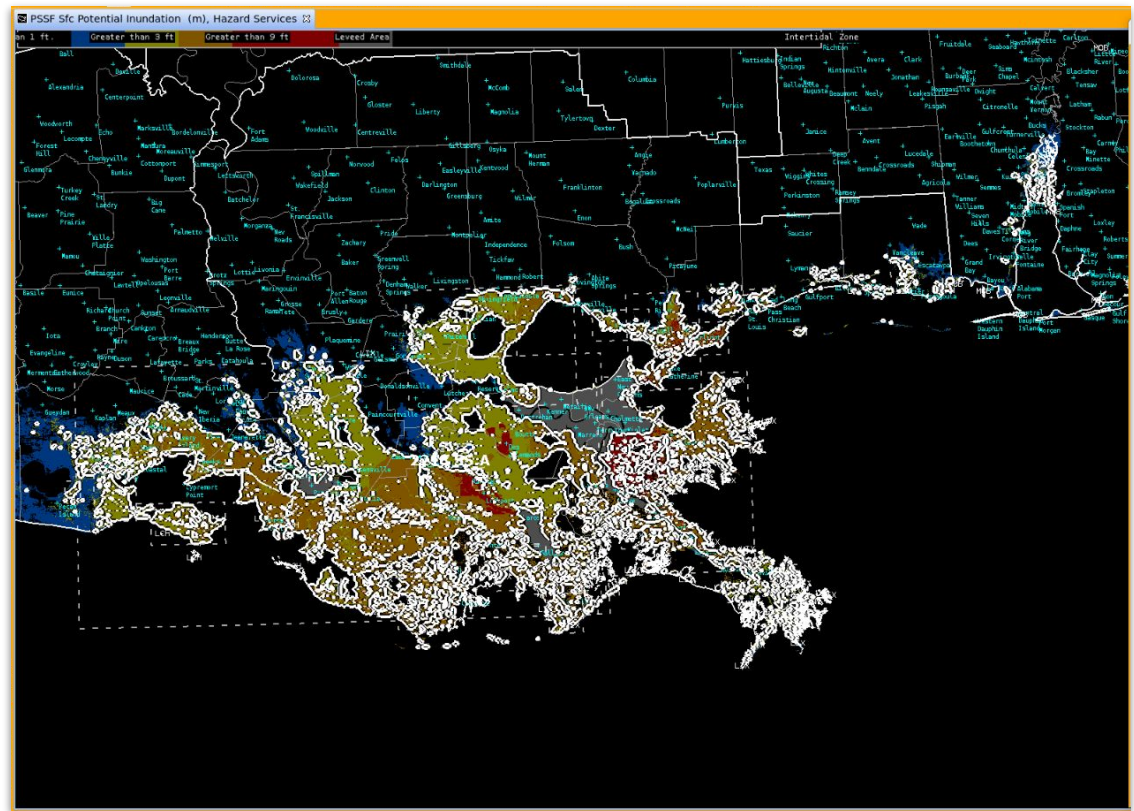
Preview... Propose

# Proposed Forecaster Workflow



Outputs Include:

3.) Storm Surge  
Watch/Warning KML



- In collaboration with the National Hurricane Center
  - Hurricane Ida
- Worked with the NHC during Hurricane Ida to generate a parallel version of the Storm Surge Watch/Warning in real-time
- NHC forecaster used Hazard Services to compose the warning from Adv 05 with guidance from GSL
  - CAP message generated
  - Legacy text product generated
  - Storm Surge Watch/Warning



- CAVE File View Options Tools Volume Obs NCEP/Hydro Local Upper Air Satellite Radar MRM/5 SCAN Maps Help

Valid time seq CONUS Clear [Icons] Frames: 12 • Map: 1.0 • Density: 1.0 • WarnGen [Icon]

PSF 5fc Potential Inundation (m), Hazard Services [Icons]

Greater than 3 ft Greater than 9 ft Leveed Area

Intertidal Zone

31-Aug (Mon)

31-Aug (Tue)

Storm Surge

```
<?xml version="1.0" encoding="UTF-8"?><alert xmlns="urn:ois:names:tc:emergency:cap:1.2"><identifier>urn:oid:2.49.0.1.040.0.4398f82f8986c0ee79122067ce187ab5324e8e.001.001</identifier><sender>no-nbsmaster@noaa.gov</sender><sent>2021-08-30T18:53:00-00:00</sent><status>actual</status><msgType>Alert</msgType><scope>Public</scope><code>PMD01.0</code></note></><info><Language>en-US</Language><category>Met</category><event>Storm Surge Watch</event><responseType>urgency</responseType><severity>certainty</severity><eventCode><valueName>SAME</valueName><value>NWS</value></eventCode><eventCode><valueName>NationalWeatherService</valueName><value>SSA</value></eventCode><effective>2021-08-30T18:53:00-00:00</effective><onset>2021-08-30T18:53:00-00:00</onset><expires>2021-08-30T21:00:00-00:00</expires><senderName>NWS Ocean Prediction Center Washington DC</senderName><headline>Storm Surge Watch issued August 30 at 06:53PM UTC expiring August 30 at 00</headline><description>This is for storm surge.</description></instruction></><webhttp://www.weather.gov/web</web><parameter><valueName>VTEC</valueName><value>O.NEX.KNBC.SS.A.0901.210830T1853Z-210830T2051Z</value></parameter><valueName>EAS-ORG</valueName><value>NWS</value></parameter><valueName>PIL</valueName><value>TV</value></parameter><valueName>eventEndTime</valueName><value>2021-08-30T20:51:00-00:00</value></parameter><valueName>TIME..POT..LOC</valueName></parameter><valueName>headline</valueName><value>STORM SURGE WATCH IN EFFECT</value></parameter><valueName>BLOCKCHANNEL</valueName></parameter></></>
```

Hazard Data Editor Storm Surge Formatter CAP Formatter

Issue All Dismiss

Hazard Services Console: Storm Surge - ONP 21

| Event ID | Lock Status | Hazard Type | Status     | Start Time | End Time | Expiration Time | VTEC Actions |
|----------|-------------|-------------|------------|------------|----------|-----------------|--------------|
| 2218 U   | SS.A        | PENDIN      | 18:53Z 30A | 20:51Z 30  |          |                 |              |

30-Aug (Mon)

31-Aug (Tue)

Frames: 1/1 Time: 18:53Z 30-Aug-21 743M of 1432M

- Implement tool to modify an existing hazard event via maps provided by the NHC
- Implement “punch out” tool (upgrade SS.A to SS.W)
- Continued software iteration working with NHC forecasters in real-time environment
- Host evaluation at the NHC testbed via dedicated cloud instance
  - NOT currently funded through JTTI (currently via STI)
  - Supports existing and future testbed activities



# Contact and Questions

## Global Systems Laboratory

### Evaluation and Decision Support Division

#### Weather Information Systems Evolution (WISE)

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